Before the
Federal Communications Commission
Washington, DC 20554

In the matter of	)	
	)	
Amendment of Part 101 of the Commission's	)	WT Docket No. 07-54
Rules to Increase Spectrum Use Through More	)	RM-11043
Flexible Antenna Rules for the 10.7-11.7 GHz	)	
Band	)	

COMMENTS OF ALCATEL-LUCENT

Alcatel-Lucent[1] respectfully submits the following comments in the above-captioned proceeding.[2] Alcatel-Lucent is an international provider of telecommunications equipment – including microwave radio products – and is a world leader in wireless and wireline broadband communications technology. Alcatel-Lucent provides a broad portfolio of communications solutions to a wide range of commercial and government users.

As discussed herein, Alcatel-Lucent reiterates its support for the proposed modification of Part 101 of the Federal Communications Commission's ("Commission") Rules which would permit the use of two-foot antennas in the 10.7-11.7 GHz band ("11 GHz band").[3] Allowing for the use of a smaller antenna will grant licensees in this band

[1] Alcatel and Lucent Technologies, Inc., two leading global telecommunications equipment manufacturing companies, merged on November 30, 2006 to create Alcatel-Lucent. Alcatel-Lucent hereby adopts in full the pleadings and positions of the former Alcatel in this proceeding.
[2] *Amendment of Part 101 of the Commission's Rules to Modify Antenna Requirements for the 10.7-11.7 GHz Band*, Notice of Proposed Rulemaking, WT Docket No. 07-54 (Released March 27, 2007) ("NPRM").
[3] *Amendment of Part 101 of the Commission's Rules to Modify Antenna Requirements for the 10.7-11.7 GHz Band*, Comments of Alcatel, Docket No. RM-11043 (Filed August 23, 2004) ("Alcatel Comments").

greater flexibility in the deployment of services and will promote greater overall efficiency in the band's use.

Alcatel-Lucent agrees with the goals of the NPRM and specifically endorses the goal for licensees to realistically deploy 2-ft. to 4-ft. antennas in the near term. Accordingly: (1) any Part 101 rule changes suggested herein are intended to embrace that goal; and (2) Alcatel-Lucent recognizes that other parties may suggest different Part 101 rule changes that seek to achieve the same goal. Several parties to this proceeding have been in consultation toward presenting a consolidated industry approach in the Reply Comment and Ex Parte rounds.

I. THE COMMISSION'S PROPOSED RULE CHANGES WILL FACILITATE THE FURTHER DEPLOYMENT OF MICROWAVE SERVICES

In its Notice of Proposed Rulemaking ("NPRM"), the Commission seeks comment on whether the rule changes proposed by FiberTower[4] would facilitate deployment of a range of microwave applications in the 11 GHz band.[5] By amending its Part 101 Fixed Microwave Services rules to allow for the use of 2-ft antennas in the 11 GHz band, the Commission will allow licensees to deploy systems and services at 11 GHz in locations that cannot accommodate a 4-ft. antenna.

For instance, the Commission likewise increased deployment in the 10 GHz band as a result of antenna size rule changes made in 2002.[6] The number of 2- and 2.5-ft antennas in the 10 GHz band increased at a rate 217% faster than the number of 4-ft or

[4] *Amendment of Part 101 of the Commission's Rules to Increase Spectrum Use Through More Flexible Antenna Rules for the 10.7-11.7 GHz Band*, Docket No. RM-11043, Petition for Rulemaking (Filed on May 26, 2004) ("FiberTower Petition").
[5] NPRM, ¶ 17.
[6] *Amendment of Part 101 of the Commission's Rules to Streamline Processing of Microwave Applications in the Wireless Telecommunications Services,* WT Docket No. 00-19, *Report and Order* (adopted July 18, 2002) ("2002 Part 101 R&O").

larger antennas deployed in the 2002-2007 timeframe immediately following the rule modification.[7] This data depicts the strong demand for the ability to deploy antennas of sizes less than 2.5 ft as a result of the Commission's actions.

Moreover, a 2-ft. antenna has one-third the wind loading of a 4-ft. antenna thereby allowing for the use of 2-ft. antennas on tower structures that are not strong enough to withstand the load of a 4-ft. antenna. This factor, combined with the improved aesthetic appeal of 2-ft. antennas, portends an increase in the overall use of the 11 GHz band.

Finally, the 11 GHz band offers 1000 MHz of spectrum whereas the next band in which both large RF channels and 2-ft. antennas are permitted is the 18 GHz band, which now offers only 840 MHz of spectrum for Part 101 applications. Thus, permitting the use of smaller antennas will encourage more efficient use of spectrum and will ultimately lower costs for end users by allowing for the deployment of additional microwave links at space- and weight-limited facilities that were previously unavailable. As the previously filed Alcatel White Paper demonstrates, by creating greater access to such facilities, the Commission will ease installation of new links and speed deployment of new links and services.[8]

II. INTERFERENCE CONCERNS VIS-À-VIS 2-FT. ANTENNAS ARE ADEQUATELY ADDRESSED BY THE PROPOSED AMENDMENTS.

The Commission seeks comment on the FiberTower proposal's amendments to Section 101.103 of the Commission's Rules which would require an FS licensee to limit predicted interference from a 2-ft. antenna to a level no higher than that which would be

[7] Based on data from the FCC's Universal Licensing System (ULS) database.

[8] *Amendment of Part 101 of the Commission's Rules to Modify Antenna Requirements for the 10.7-11.7 GHz Band*, Comments of Alcatel, "White Paper Report on Proposed Changes to Small Antenna Standards in the 11 GHz Band," Docket No. RM-11043, at 1 (Filed August 23, 2004) (attaching "Alcatel White Paper" in Appendix A).

expected to be caused by the use of a 4-ft. antenna.[9] Alcatel-Lucent agrees that these measures are sufficient to address the heightened interference concerns cited by those parties opposed to FiberTower's petition. This approach provides the greatest flexibility of use in the 11 GHz band while maintaining the lowest possible level of interference between FS and FSS in the band. Furthermore, given the Commission's acknowledgement that current FSS use of the 11 GHz band has been "limited,"[10] Alcatel-Lucent contends that the amendments proposed by FiberTower – that an FS or FSS applicant may require an FS licensee using a 2-ft antenna to reduce predicted interference to levels no greater than those predicted from an 4-ft antenna and the accompanying changes to the antenna specifications outlined in Section 101.115(b) of the Commission's rules – promote the most efficient use of the 11 GHz spectrum while still providing a mechanism to resolve any potential harm from interference.

III. ANY POTENTIAL INTERFERENCE DUE TO POINTING ERROR IS MINIMAL AND CAN BE EFFECTIVELY MANAGED BY LICENSEES.

The NPRM seeks comment on the potential problems posed by pointing error in the installation of antennas in this band.[11] On this issue, Alcatel-Lucent concurs with FiberTower's assertion that licensees have every incentive to ensure that their antennas are aimed correctly so as to avoid interference with other users in the band.[12] Pointing error degrades not only the service of adjacent licensees in the band but also degrades the service enjoyed by the antenna operator's own end-users. An antenna that is professionally installed, properly pointed, and operated within the Commission's

[9] FiberTower Reply Comments at 5.
[10] NPRM, ¶ 18.
[11] Id., ¶ 25.
[12] *Amendment of Part 101 of the Commission's Rules to Modify Antenna Requirements for the 10.7-11.7 GHz Band*, Reply Comments of FiberTower, Inc., Docket No. RM-11043 (Filed September 7, 2004), at 5.

guidelines should not cause interference with adjacent licensees in the band.[13] To the degree that pointing error might cause interference with other licensees in the band, it is both feasible and in the best interest of both parties to resolve the interference quickly so as to maintain the desired level of service for customers.

IV. THE COMMISSION'S RULES AND INDUSTRY NORMS ARE SUFFICIENT TO ENSURE INTERFERENCE MITIGATION.

The Commission seeks comment on whether its rules and industry practices are sufficient to remedy interference concerns where 2-ft. antennas cause more interference than would have been caused by a 4-ft. antenna.[14] Alcatel-Lucent believes that current industry practices and the Commission's rules are sufficient to ensure that interference concerns are addressed and remedied in a timely fashion in instances where a 2-ft.antenna causes more interference than would be caused by a 4-ft. antenna, again reminding the Commission that licensees have every incentive to ensure minimal interference to other licensees in the band.

Conclusion

Alcatel-Lucent strongly supports FiberTower's petition and urges the Commission to modify its Part 101 rules so as to encourage the most efficient use of the 10.7-11.7 GHz spectrum. As the Alcatel White Paper and other comments in this proceeding demonstrate, the potential for increased interference caused by 2-ft. antennas as opposed to 4-ft. antennas is minimal and can be properly managed so as to allow the continued co-existence of FS and FSS in the 11 GHz band, thereby ensuring that the 11 GHz band is used the most efficient manner possible.

[13] Alcatel Comments at 2.
[14] Id., ¶ 27.

Respectfully Submitted,

ALCATEL-LUCENT

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APPENDIX A

White Paper Report

on

Proposed Changes to Small Antenna Standards

in the

11 GHz Band

Prepared by

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for

Alcatel N.A.

Rev. 0 June 24, 2004
Rev. 1 August 23, 2004

Comparison Path Studies
for
Small Antenna Standard in 11 GHz Band

BACKGROUND:

FiberTower, Inc. has filed a petition for rulemaking with the FCC to allow the use of 2-foot antennas in the 11 GHz band. This white paper report presents the results of comparison path studies for determining the impact of the proposed, alternate small antenna standards in the 10.7-11.7 GHz (11 GHz) band.

SUMMARY OF RESULTS:

The off-axis gain characteristics of the proposed, alternate Category A (New A) antenna standard in the 11 GHz band are comparable to the current Category A requirement for radiation suppression because of the reduced main beam gain.

> Off-Axis Gain (dBi) = Main Beam Gain (dBi) – Radiation Suppression* (dB)
> [*as specified in antenna standards table, FCC Rules §101.115]

As a result, calculated interference levels using the New A antenna will be lower at angles between 10-30 degrees and 100-180 degrees off-axis compared to an actual, i.e., production model, Category A antenna having a main beam gain of 40.4 dBi and only 0**.**1 dB higher between 5-10 degrees and 30-100 degrees. (See graph titled "Off-Axis Gain Comparison" on page 13 of this report.)

Therefore, the separation between microwave paths with different combinations of antennas (i.e., current Category A and New A) is more dependent on the respective transmitter power of each path than on the antenna performance or off-axis gain.

The advantages of smaller, 2-foot, antennas (e.g., size, cost, ease of installation) would facilitate the installation of more microwave paths in metropolitan areas using lower power transmitters on shorter paths, thereby resulting in a greater utilization of the 11 GHz microwave spectrum.

METHODOLOGY:

This white paper presents the results of twenty-two (22) different combinations of path length, antenna model, and transmitter power that were used to evaluate the impact of the proposed changes for small antenna standards in the 11 GHz band. The same interference objective of -103 dBm was used in all cases, based on a -69 dBm receiver threshold for 3 DS-3 radios and a T/I ratio of 34 dB. A total of 528 simplified interference calculations were made for these comparison path studies.

Four different parallel path length configurations were used for this study: 10 mi. – 10 mi., 5 mi. – 10 mi., 2 mi. – 10 mi., and 2 mi. – 2 mi.

The off-axis angle, θ_1, at Site A (same angle at Site D) was adjusted in 10-degree increments from 10 degrees to 60 degrees. The corresponding off-axis angle, θ_2, at Site B (same angle at Site C) was then calculated for each increment along with the path distance and free space loss between Sites A and D and Sites B and C. (Refer to Figure 1, Path Study Configuration.) Interference levels were then calculated and compiled. (See page 8 for a Comparison Chart sample with the results of one path study.)

An overview table of the 22 path studies lists the minimum off-axis angle that could be used for each path configuration and the resultant separation distance between the parallel paths. (Refer to page 15.) Conclusions stated in this report are based on this data and the antenna off-axis gain tables and graphs presented on pages 11-13.

OBSERVATIONS:

The proposed, alternate Category A (New A) antenna standard is basically the same as the current Category B antenna standard except for an improvement of 19 dB in radiation suppression between 100 –180 degrees off-axis from the main beam and 2 dB less radiation suppression between 5-10 degrees off-axis.

The proposed, alternate Category B (new B) antenna pattern is basically the same as the current Category B antenna pattern except for a 4 dB improvement between 100-140 degrees off-axis and a 9 dB improvement between 140-180 degrees off-axis. The new B pattern proposes a 3 dB relaxation of radiation suppression between 5-10 degrees off-axis.

The calculation of interference levels into foreign stations (i.e., any station other than the desired receive station) takes into account the off-axis gain of the respective transmit and receive antennas. (Refer to Figures 1. and 2., Path Study Configurations.)

$I_{CB} = I_{BC}$* when P_C is the same as P_B (reference equations 2 and 8, respectively) and $I_{DA} = I_{AD}$ when P_D is the same as P_A (reference equations 6 and 4, respectively). In each pair of referenced equations all of the terms are equivalent except for the transmitter powers. Therefore, when the transmitter powers are the same (assuming similar rack configurations), the calculated level of interference will be the same in both directions, i.e. I_{CB} (Site C to Site B) will equal I_{BC} (Site B to Site C). (Refer to Figure 3., Interference Path Calculations diagram on page 14.)

**** Key to terms used in the paragraph above and in the following sections of this report:***

For example:

$$C_{AB} = P_A - L_A + G_A - FSL_{AB} + G_B - L_B \qquad \text{Eq. 1}$$

$$I_{CB} = P_C - L_C + G_{C\theta 2} - FSL_{CB} + G_{B\theta 2} - L_B \qquad \text{Eq. 2}$$

where:

C_{AB} = carrier or signal level on the desired path from Site A to Site B in dBm,
P_A = transmitter power level at Site A in dBm,
L_A = line losses at Site A in dB,
G_A = main beam gain of the antenna at Site A in dBi,
FSL_{AB} = free space loss for path between Site A and Site B in dB,
G_B = main beam gain of the antenna at Site B in dBi,
L_B = line losses at Site B in dB,
and
I_{CB} = interference signal level from Site C received at Site B in dBm,
$G_{C\theta 2}$ = off-axis gain (in dBi) of the antenna at Site C at the off-axis angle of θ_2,
$G_{B\theta 2}$ = off-axis gain (in dBi) of the antenna at Site B at the off-axis angle of θ_2.

CONCLUSIONS:

The off-axis gain characteristics of the proposed, alternate Category A (New A) antenna in the 11 GHz band are comparable to the current Category A requirement because of the reduced main beam gain.

> Off-Axis Gain (dBi) = Main Beam Gain (dBi) – Radiation Suppression (dB)
> [as specified in antenna standards table, FCC Rules §101.115]

As a result, calculated interference levels using the New A antenna will be lower at angles between 10-30 degrees and 100-180 degrees off-axis compared to an actual, i.e., production model, Category A antenna (having a main beam gain of 40.4 dBi) and only 0.1 dB higher between 5-10 degrees and 30-100 degrees.

Short paths with lower power transmitters will be disadvantaged with respect to longer paths using standard power; therefore, larger discrimination angles are needed to meet the threshold interference requirement. Because of the comparable off-axis gain characteristics of the New A standards with respect to the current standards, the impact on path separation is about the same for both antenna standards.

Many 11 GHz links have a low number of RF channels in operation; therefore, interference conflicts can also be prevented by selecting alternate channels to avoid co-channel frequency operation.

The New A antenna is not suitable for one end of a 10-mile path because of insufficient fade margin to combat predicted rainfall outage in the Dallas area and equivalent rainfall regions.

The use of the New A antenna at both ends of a 5-mile path would meet the minimum fade margin requirement for vertical polarization, but not for horizontal polarization in a rainfall region equivalent to that of Dallas, Texas.

Path Study Configuration (1 of 2)
Small Antenna Comparison
11 GHz Band

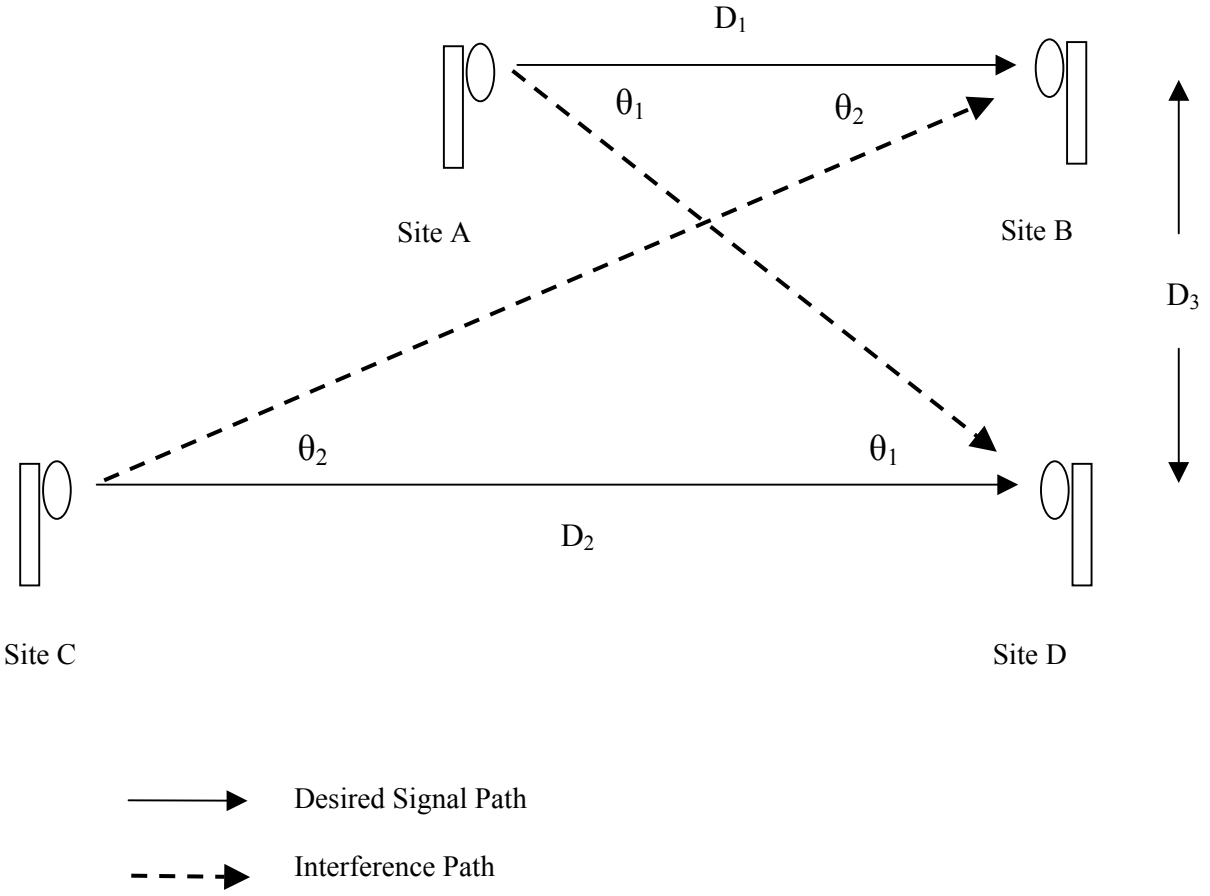


Figure 1. Path Study Configuration for I_{AD} and I_{CB}

$$C_{AB} = P_A - L_A + G_A - FSL_{AB} + G_B - L_B \quad \text{Eq. 1}$$

$$I_{CB} = P_C - L_C + G_{C\theta 2} - FSL_{CB} + G_{B\theta 2} - L_B \quad \text{Eq. 2}$$

$$C_{CD} = P_C - L_C + G_C - FSL_{CD} + G_D - L_D \quad \text{Eq. 3}$$

$$I_{AD} = P_A - L_A + G_{A\theta 1} - FSL_{AD} + G_{D\theta 1} - L_D \quad \text{Eq. 4}$$

Path Study Configuration (2 of 2)

Small Antenna Comparison
11 GHz Band

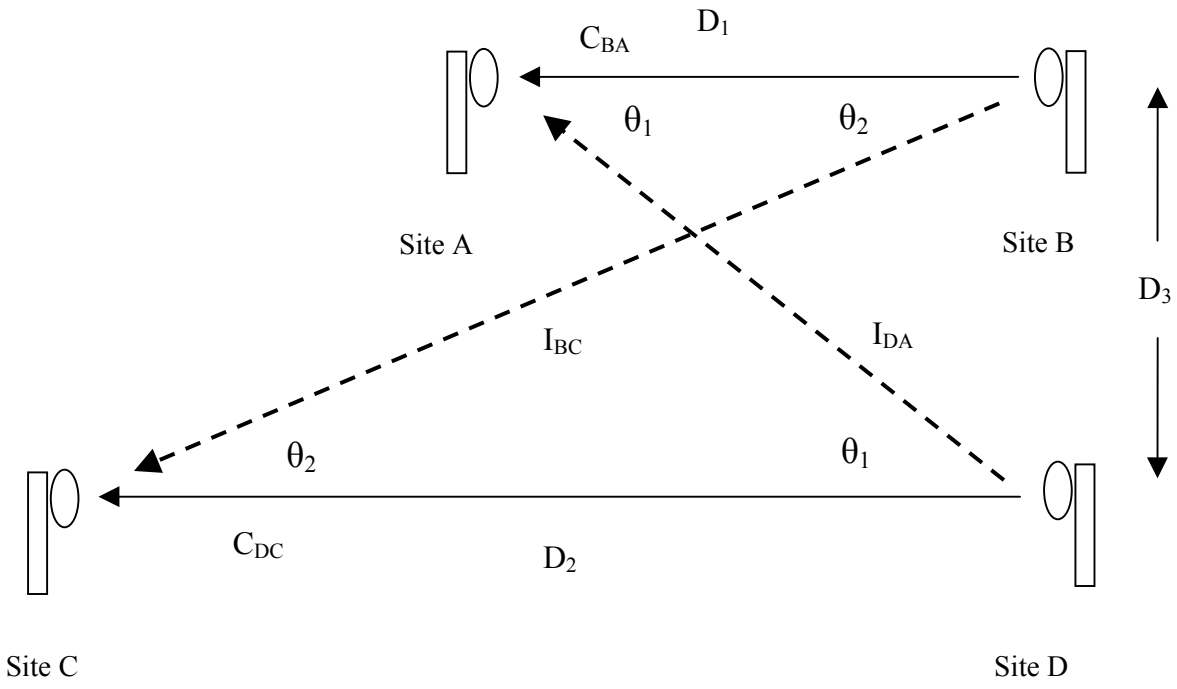


Figure 2 Path Study Configuration for I_{DA} and I_{BC}

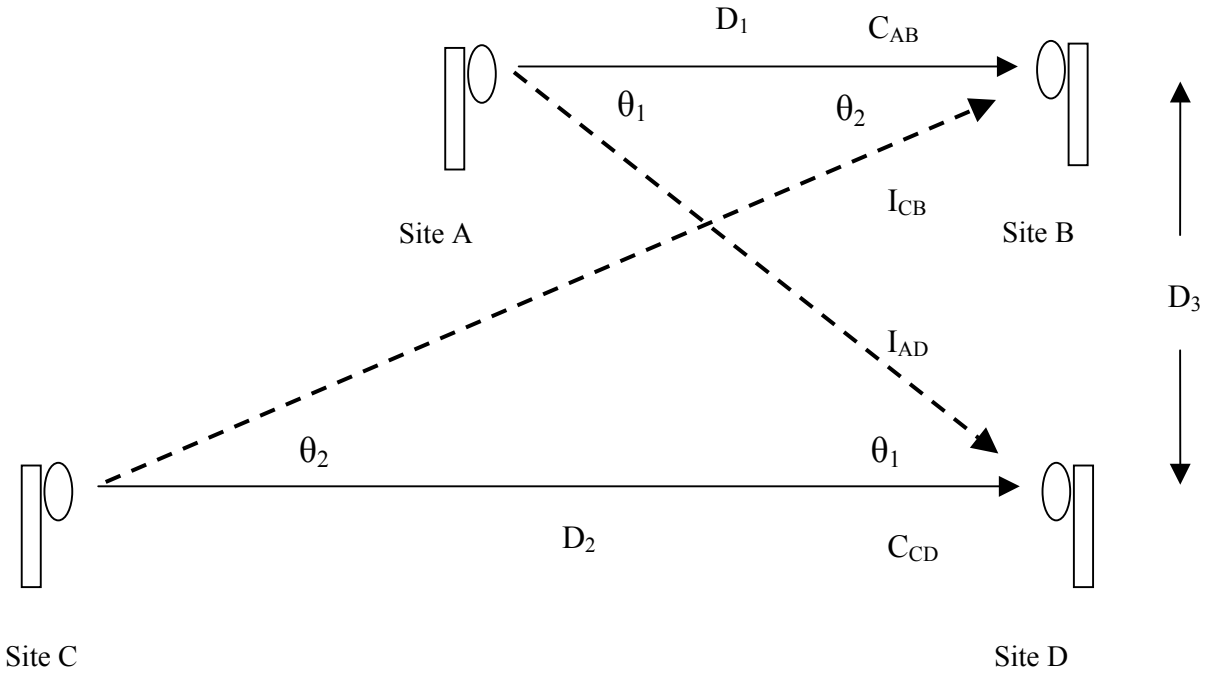
$$C_{BA} = P_B - L_B + G_B - FSL_{BA} + G_A - L_A \quad \text{Eq. 5}$$

$$I_{DA} = P_D - L_D + G_{D\theta 1} - FSL_{DA} + G_{A\theta 1} - L_A \quad \text{Eq. 6}$$

$$C_{DC} = P_D - L_D + G_D - FSL_{DC} + G_C - L_C \quad \text{Eq. 7}$$

$$I_{BC} = P_B - L_B + G_{B\theta 2} - FSL_{BC} + G_{C\theta 2} - L_C \quad \text{Eq. 8}$$

Small Antenna Comparison
11 GHz Band



Desired Signal Path

Interference Path

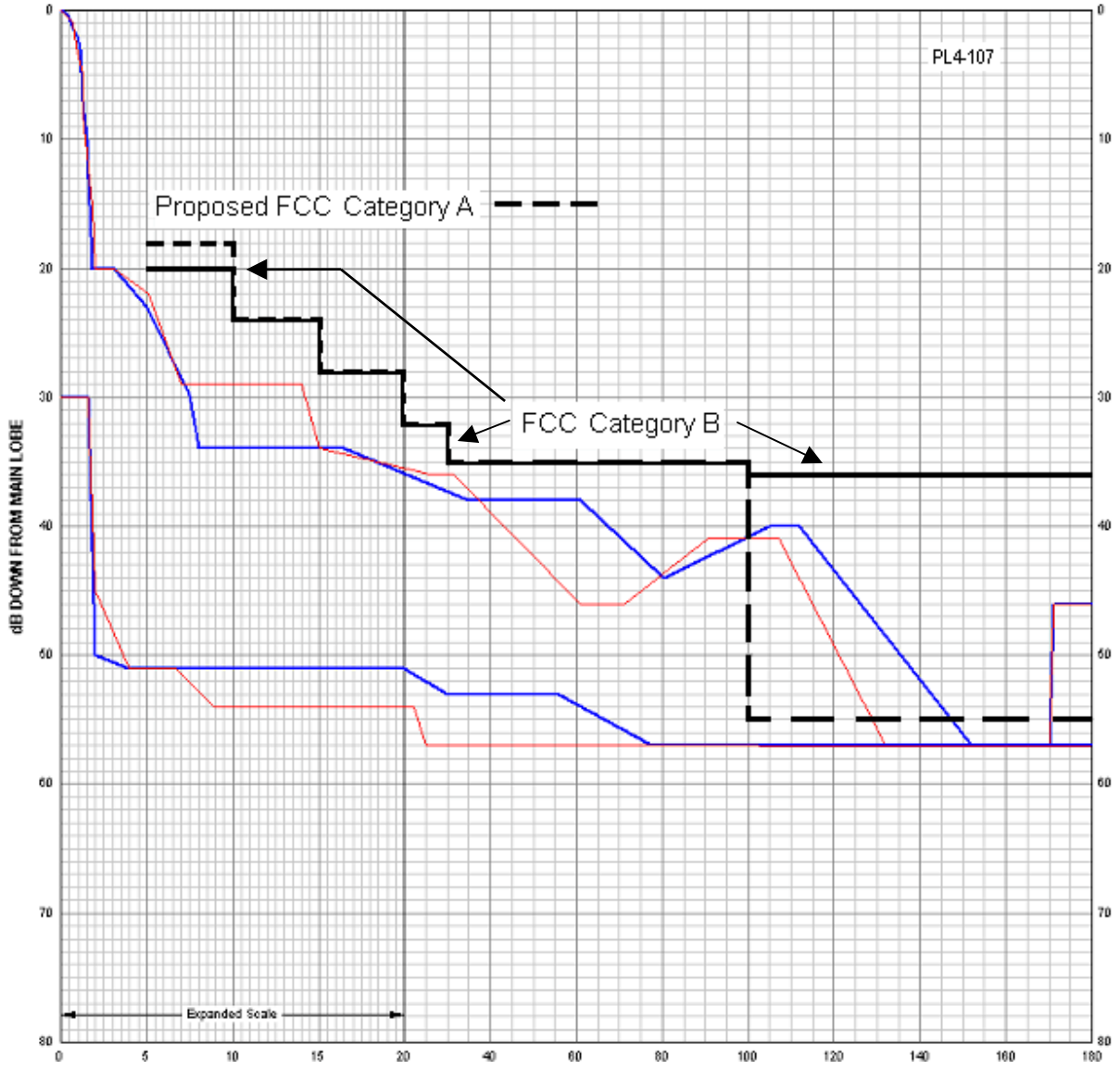
Table of Off-Axis Angles

5 Mi. : 10 Mi. Path Configuration

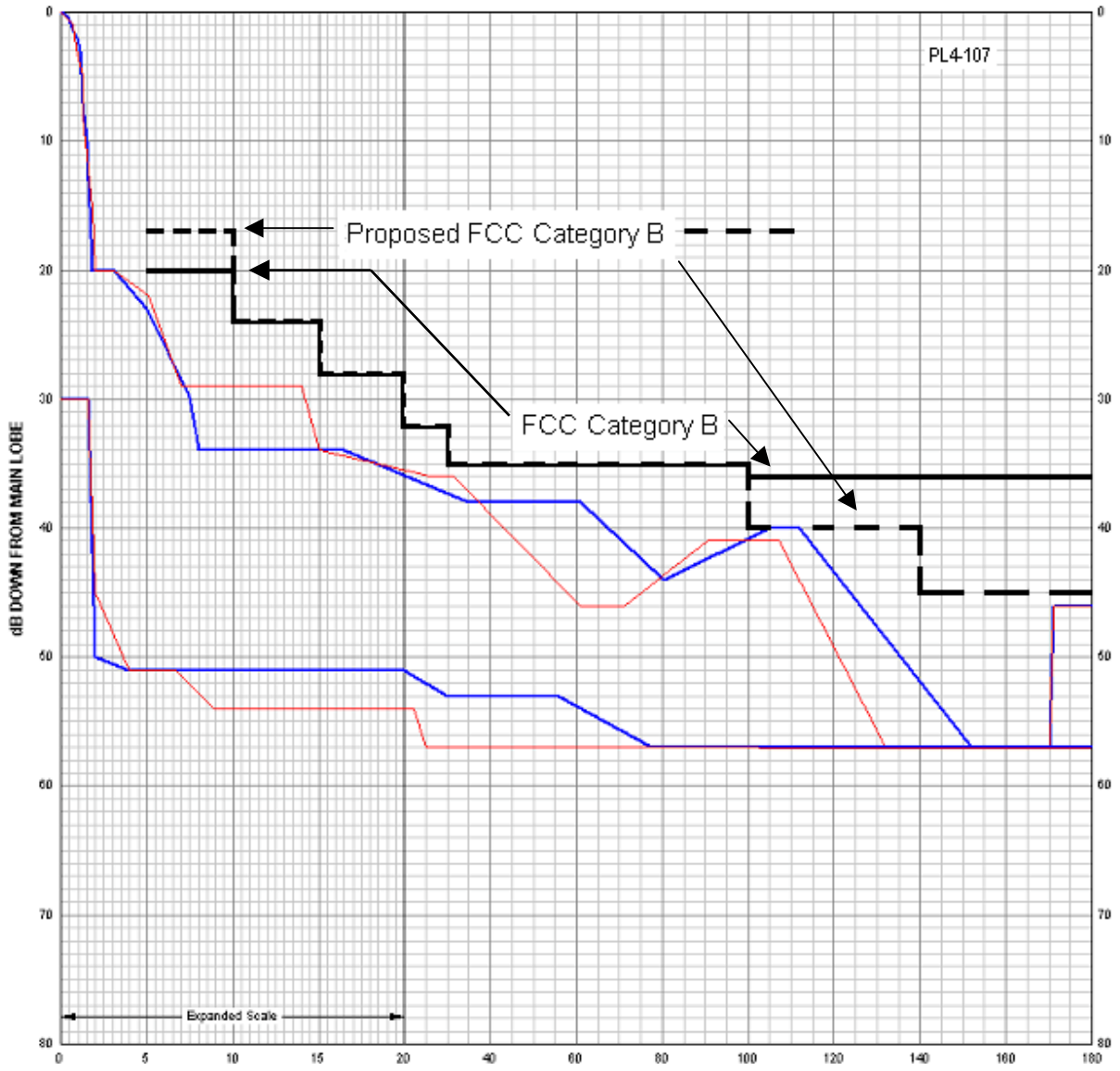
Off-Axis Angle θ_1 : θ_2
10° : 5.04°
20° : 10.3°
30° : 16.1°
40° : 22.8°
50° : 30.8°
60° : 40.9°

Case #	COMPARISON CHART FOR SMALL ANTENNAS IN 11 GHz BAND							
				SAMPLE				
		D1					**D2**	
		Length A-B in miles	Free Space Loss (dB)				Length C-D in miles	Free Space Loss (dB)
		2	123.6				10	137.6
	θ_1			**D3**		**θ_2**		
	Angle BAD, CDA (Deg)	Length AD, DA (Mi)	Free Space Loss (dB)	Separation B-D (Mi.)		Angle ABC, DCB (Deg)	Length BC, CB (Mi)	Free Space Loss (dB)
	10	2.0	123.7	0.4		2.02	10.0	137.6
	20	2.1	124.1	0.7		4.2	10.0	137.6
	30	2.3	124.9	1.2		6.6	10.1	137.6
	40	2.6	125.9	1.7		9.5	10.1	137.7
	50	3.1	127.4	2.4		13.4	10.3	137.8
	60	4.0	129.6	3.5		19.1	10.6	138.1
13	HP4 (AB) and HP6 (CD)							
	P_{TX} (dBm) >	15 : 27			15 : 27		Fade Margin in dB	
	C_{AB}	-33.8	Off-axis angle	C_{BA}	-33.8		35.2	
	I_{CB}	-70.2	2.02 : 10	I_{DA}	-84.3			
	I_{CB}	-84.2	4.2 : 20	I_{DA}	-96.7			
	I_{CB}	-90.7	6.6 : 30	I_{DA}	-103.5			
	I_{CB}	-96.3	9.5 : 40	I_{DA}	-106.5			
	I_{CB}	-98.4	13.4 : 50	I_{DA}	-111.0			
	I_{CB}	-107.1	19.1 : 60	I_{DA}	-119.2			
		for P_A, P_B = 15 and P_C, P_D = 27					Fade Margin in dB	
	C_{CD}	-28.6	Off-axis angle	C_{DC}	-28.6		40.4	
	I_{AD}	-96.3	10 : 2.02	I_{BC}	-82.2			
	I_{AD}	-108.7	20 : 4.2	I_{BC}	-96.2			
	I_{AD}	-115.5	30 : 6.6	I_{BC}	-102.7			
	I_{AD}	-118.5	40 : 9.5	I_{BC}	-108.3			
	I_{AD}	-123.0	50 : 13.4	I_{BC}	-110.4			
	I_{AD}	-131.2	60 : 19.1	I_{BC}	-119.1			

Andrew Model PL4-107 Microwave Dish Antenna Pattern
with
FCC Category B and Proposed Category A



Andrew Model PL4-107 Microwave Dish Antenna Pattern
with
FCC Category B and Proposed Category B



11 GHz Small Antenna Standards

Comparison of Off-Axis Gain

Off-axis angle	Current Category A Radiation Suppression (dB)	Off-axis Antenna Gain* (dBi)	EIRP w/+24 dBm (27 -3 dB)** dBm	New A Δ Gain (dB)	Off-axis angle	Proposed Category A Radiation Suppression (dB)	**Off-axis Antenna Gain "New A" (dBi)**	EIRP w/+24 dBm (27 - 3 dB)* dBm	EIRP w/+12 dBm (Short) (Link) dBm
0°	0	**38**	+62	**(dB)**	0°	0	**34**	+58	+46
5° - 10°	25	+13	+37	**3**	5° - 10°	18	**+16**	+40	+28
10° - 15°	29	+9	+33	**1**	10° - 15°	24	**+10**	+34	+22
15° - 20°	33	+5	+29	**1**	15° - 20°	28	**+6**	+30	+18
20° - 30°	36	+2	+26	**0**	20° - 30°	32	**+2**	+26	+14
30° - 100°	42	-4	+20	**3**	30° - 100°	35	**-1**	+23	+11
100° - 140°	55	-17	+7	**-4**	100° - 140°	55	**-21**	+3	-9
140° - 180°	55	-17	+7	**-4**	140° - 180°	55	**-21**	+3	-9

	P4-107	EIRP	New A		P6-107	EIRP	New A
0°	**40.4**	+64.4	**Δ Gain**	0°	**44.0**	+68	**Δ Gain**
(Cat. A)	(dBi)	(dBm)	**(dB)**	(Cat. A)	(dBi)	(dBm)	**(dB)**
5° - 10°	+15.4	+39.4	**0.6**	5° - 10°	+19	+43	**-3**
10° - 15°	+11.4	+35.4	**-1.4**	10° - 15°	+15	+39	**-5**
15° - 20°	+7.4	+31.4	**-1.4**	15° - 20°	+11	+35	**-5**
20° - 30°	+4.4	+28.4	**-2.4**	20° - 30°	+8	+32	**-6**
30° - 100°	-1.6	+22.4	**0.6**	30° - 100°	+2	+26	**-3**
100° - 140°	-14.6	+9.4	**-6.4**	100° - 140°	-11	+13	**-10**
140° - 180°	-14.6	+9.4	**-6.4**	140° - 180°	-11	+13	**-10**

	HP4-107	EIRP	New A		HP6-107	EIRP	New A			HP8-107	EIRP	New A
0°	**40.4**	+64.4	**Δ Gain**	0°	**44.0**	+68	**Δ Gain**	0°	0	**46.4**	+70.4	**Δ Gain**
Actual	(dBi)	(dBm)	**(dB)**	Actual	(dBi)	(dBm)	**(dB)**		Actual	(dBi)	(dBm)	**(dB)**
5° - 10°	+15.4	+39.4	**0.6**	5°	+14	+38	**2**	5°	30	+16.4	+40.4	**-0.4**
10° - 15°	+10.4	+34.4	**-0.4**	6° - 9°	+11.5	+35.5	**4.5**	5.5° - 7°	31	+15.4	+39.4	**0.6**
15° - 20°	+7.4	+31.4	**-1.4**	9.5° - 15°	+8	+32	**2**	7.5° - 9°	33	+13.4	+37.4	**2.6**
20° - 30°	+4.4	+28.4	**-2.4**	20° - 30°	+2	+26	**0**	10.5°	37	+9.4	+33.4	**0.6**
30° - 55°	-1.6	+22.4	**0.6**	50°	-2	+22	**1**	15°	38	+8.4	+32.4	**-2.4**
60° - 65°	-4.6	+19.4	**3.6**	99°	-25	-1	**24**	25°	47	-0.6	+23.4	**2.6**
70° - 75°	-13.6	+10.4	**12.6**	102° - 180°	-26	-2	**5**	40°	48	-1.6	+22.4	**0.6**
76° - 90°	-16.6	+7.4	**15.6**					60°	53	-6.6	+17.4	**5.6**
95° - 180°	-20.6	+3.4	**-0.4**					98°	71	-24.6	-0.6	**23.6**
								100° - 180°	72	-25.6	-1.6	**4.6**

* Off-axis Gain = Main Beam Gain - Radiation Suppression

** EIRP = Ptx - Line Loss + Gant

** EIRP = +27 dBm - 3 dB + Gant

Maximum allowable EIRP = +55 dBW (+85 dBm)

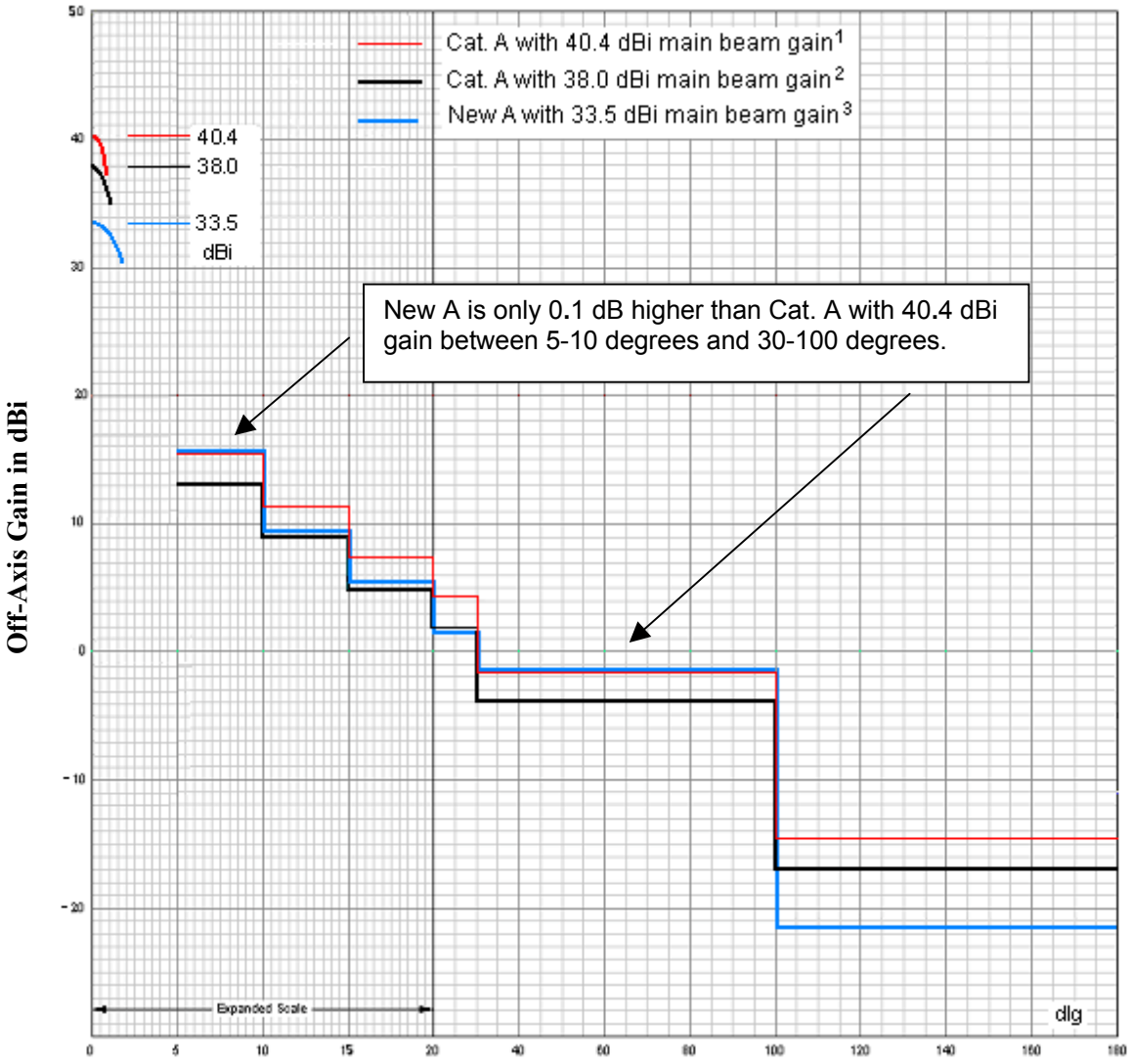
2-mile path EIRP Limit = 55-(40*LOG10(3.1/2)) = 47.4 dBW

or 77.4 dBm

dlg 06/11/04

Main Beam Antenna Gain (dBi)					Main Beam Antenna Gain (dBi)				Antenna Gain (dBi)	
38		34		<< 0° >>	40.4		44.0		46.4	
Standard A Current Off-Axis Suppression	Standard A Current Off-Axis Gain (dBi)	Standard A Proposed Off-Axis Suppression	Standard A Proposed Off-Axis Gain (dBi)	Off-Axis Angle	HP4-107 Actual Off-Axis Suppression	HP4-107 Actual Off-Axis Gain (dBi)	HP6-107 Actual Off-Axis Suppression	HP6-107 Actual Off-Axis Gain (dBi)	HP8-107 Actual Off-Axis Suppression	HP8-107 Actual Off-Axis Gain (dBi)
29	+9	24	+10	10°	30	+10.4	36	+8	35.7	+10.7
36	+2	32	+2	20°	36	+4.4	42	+2	45.5	+0.9
42	-4	35	-1	30°	42	-1.6	42	+2	47.5	-1.1
42	-4	35	-1	40°	42	-1.6	44	0	48	-1.6
42	-4	35	-1	50°	43	-2.6	46	-2	50.5	-4.1
42	-4	35	-1	60°	45	-4.6	50	-6	53	-6.6
29	+9	24	+10	**10.0°**	30	+10.4	36	+8	35.7	+10.7
36	+2	32	+2	**20.0°**	36	+4.4	42	+2	45.5	+0.9
42	-4	35	-1	**30.0°**	42	-1.6	42	+2	47.5	-1.1
42	-4	35	-1	**40.0°**	42	-1.6	44	0	48	-1.6
42	-4	35	-1	**50.0°**	43	-2.6	46	-2	50.5	-4.1
42	-4	35	-1	**60.0°**	45	-4.6	50	-6	53	-6.6

Off-Axis Gain Comparison
for
Category A and New Category A Antennas



Off-Axis Gain (dBi) = Main Beam Gain (dBi) – Radiation Suppression (dB)

[1] Actual production models for high-performance antennas have a gain of 40.4 dBi.
[2] Current FCC Cat. A for mw antennas specifies a minimum main beam gain of 38.0 dBi. [as specified in antenna standards table, FCC Rules §101.115]
[3] Proposed Cat.A for antennas with a minimum main beam gain of 33.5 dBi.

Interference Path Calculations
Small Antenna Comparison
11 GHz Band

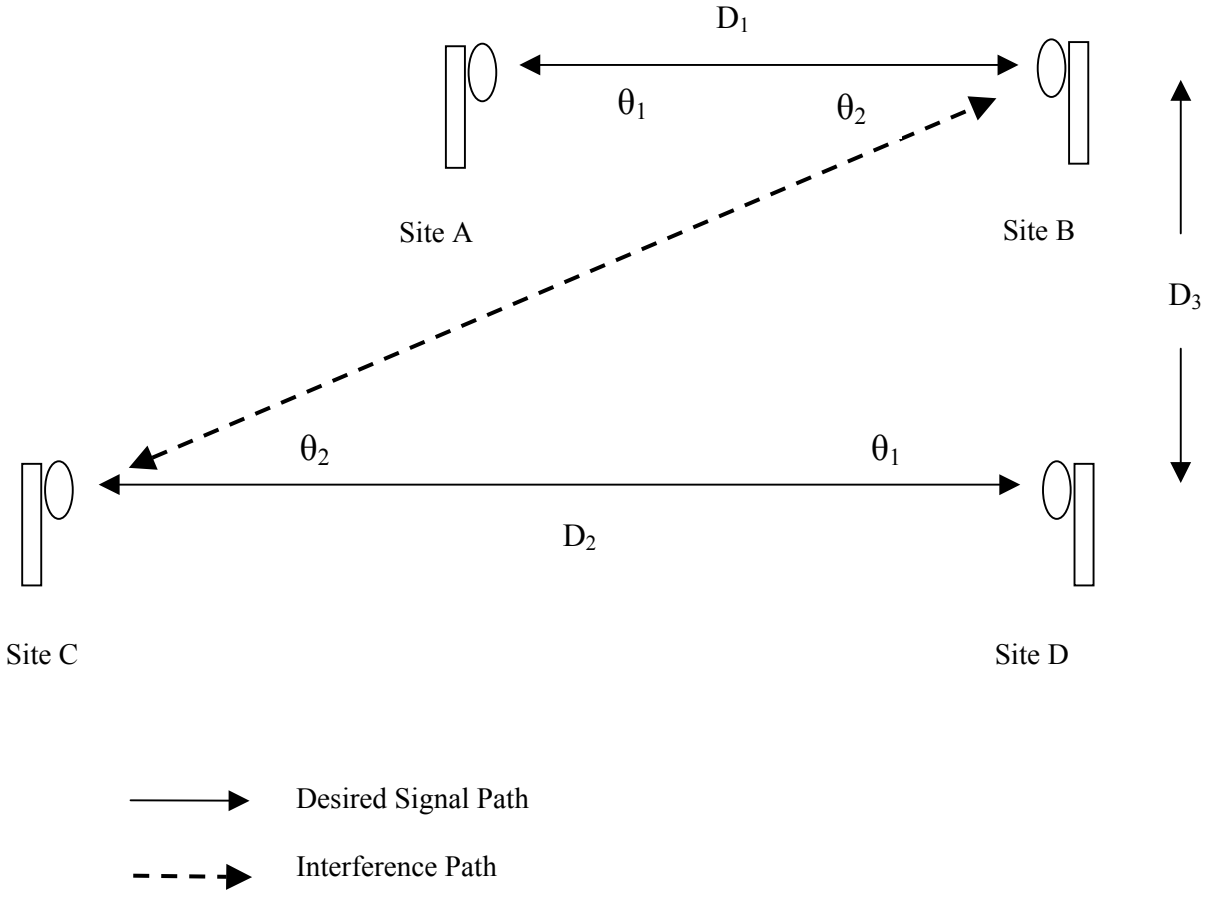


Figure 3. Interference Path Calculations for I_{CB} and I_{BC}

$$I_{CB} = P_C - L_C + G_{C\theta 2} - FSL_{CB} + G_{B\theta 2} - L_B \qquad \text{Eq. 2}$$

$$I_{BC} = P_B - L_B + G_{B\theta 2} - FSL_{BC} + G_{C\theta 2} - L_C \qquad \text{Eq. 8}$$

Case		OVERVIEW OF SMALL ANTENNA PATH STUDIES					
#							
	D1 = 10 mi.	(Min. F.M. = 35 - 40 dB)		**D2 = 10 mi.**	(Min. F.M. = 35 - 40 dB)		
	ANTENNA TYPE		**XTMR**	**FADE**	**θ1, θ2**	**D3**	**FOREIGN**
	Sites	Sites	**POWER**	**MARGIN**	Off-axis	Separation	**RSL**
	A - B	C - D	A-B : C-D	A-B : C-D	Angles	Distance	(dBm)
1	**HP6-HP6**	**HP6-HP6**	**27 : 27**	**40.4 : 40.4**	**16 : 16**	**2.9 mi.**	**-103.7**
2	**HP8-HP8**	**HP8-HP8**	**23 : 23**	**41.2 : 41.2**	**12.5:12.5**	**2.2 mi.**	**-103.2**
(3)	HP4-HP4	HP4-HP4	27 : 27	33.2 : 33.2	20 : 20.0	3.6 mi.	-108.3
(4)	New A-New A	HP4-HP4	27 : 27	20.4 : 33.2	15 : 15	2.7 mi.	-103.5
(5)	New A-New A	HP6-HP6	27 : 23	20.4 : 36.4	15 : 15	2.7 mi.	-102.9
(6)	HP6-New A	HP6-HP6	27 : 27	30.4 : 40.4	16 : 16	2.9 mi.	-103.7
(7)	HP8-New A	HP6-HP6	27 : 27	32.8 : 40.4	16 : 16	2.9 mi.	-103.4
	D1 = 5 mi.	(Min. F.M. = 24 - 28 dB)		**D2 = 10 mi.**	(Min. F.M. = 35 - 40 dB)		
	ANTENNA TYPE		**XTMR**	**FADE**	**θ1, θ2**	**D3**	**FOREIGN**
	Sites	Sites	**POWER**	**MARGIN**	Off-axis	Separation	**RSL**
	A - B	C - D	A-B : C-D	A-B : C-D	Angles	Distance	(dBm)
(8)	New A-New A	HP4-HP4	27 : 27	26.4 : 33.2	15.5 : 29	2.8	-103.5
9	New A-New A	HP6-HP6	27 : 23	26.4 : 36.4	15.5 : 29	2.8	-103.4
10	**HP4-HP4**	**HP6-HP6**	**23 : 27**	**35.2 : 40.4**	**16.1 : 30**	**2.9**	**-102.5**
(11)	HP4-New A	HP4-HP4	23 : 27	28.8 : 33.2	15.0 : 28.2	2.7	-103.1
12	HP4-New A	HP6-HP6	23 : 27	28.8 : 40.4	15 : 28.2	2.7	-102.9
	D1 = 2 mi.	(Min. F.M. = 15 dB)		**D2 = 10 mi.**	(Min. F.M. = 35 - 40 dB)		
	ANTENNA TYPE		**XTMR**	**FADE**	**θ1, θ2**	**D3**	**FOREIGN**
	Sites	Sites	**POWER**	**MARGIN**	Off-axis	Separation	**RSL**
	A - B	C - D	A-B : C-D	A-B : C-D	Angles	Distance	(dBm)
13	**HP4-HP4**	**HP6-HP6**	**15 : 27**	**35.2 : 40.4**	**16.5 : 56**	**3**	**-103.6**
14	HP4-HP4	HP6-HP6	15 : 23	35.2 : 36.4	13.9 : 51	2.5	-103.2
(15)	New A-New A	HP4-HP4	15 : 27	22.4 : 33.2	15 : 53.2	2.7	-103.5
(16)	New A-New A	HP4-HP4	23 : 27	30.4 : 33.2	15 : 53.2	2.7	-103.5
17	New A-New A	HP6-HP6	15 : 27	22.4 : 40.4	15 : 53.2	2.7	-102.9
18	New A-New A	HP6-HP6	15 : 23	22.4 : 36.4	10.2 : 42	1.8	-102.7
19	New A-New A	HP6-HP6	23 : 23	30.4 : 36.4	10.2 : 42	1.8	-102.7
	D1 = 2 mi.	(Min. F.M. = 15 dB)		**D2 = 2 mi.**	(Min. F.M. = 15 dB)		
	ANTENNA TYPE		**XTMR**	**FADE**	**θ1, θ2**	**D3**	**FOREIGN**
	Sites	Sites	**POWER**	**MARGIN**	Off-axis	Separation	**RSL**
	A - B	C - D	A-B : C-D	A-B : C-D	Angles	Distance	(dBm)
20	New A-New A	HP4-HP4	15 : 15	22.4 : 35.2	20.0 : 20	0.7	-108.7
21	New A-New A	New A-New A	15 : 15	22.4 : 22.4	15 : 15	0.5	-102.9
22	**HP4-HP4**	**HP4-HP4**	**15 : 15**	**35.2 : 35.2**	**20.0 : 20**	**0.7**	**-106.3**
Key							
#	**Bold # and font indicates control case study.**						
#	Regular font indicates viable path with New A antenna at one or more sites.						
(#)	Indicates case not meeting minimum fade margin requirement on one or both paths.						

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